Potentially Preventable Complications in Texas Medicaid and CHIP Programs

Measurement Period: Fiscal Year 2013

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The External Quality Review Organization

for Texas Medicaid Managed Care and CHIP

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Introduction

This report provides information on the occurrence of potential preventable hospital complications for enrollees of Texas Medicaid and CHIP programs during fiscal year 2013. Texas Medicaid beneficiaries had over 780,000 inpatient hospital admissions with paid amounts totaling over 5.4 billion dollars during 2013. Managed care enrollees accounted for 60% of these stays, with the remainder being paid directly by the State of Texas Medicaid-CHIP programs (fee-for-service). Reporting on the types and distribution of potentially preventable complications (PPCs) creates opportunities for targeted interventions. Reducing PPCs will have both economic and quality benefits for the State of Texas and the beneficiaries of the Texas Medicaid and CHIP programs.

Texas legislative initiatives and resources in Medicaid

For the 2012-2013 biennial budget, Texas Medicaid funding was almost $21 billion. This was more than 20% of state tax revenues. Including federal funds, the Texas Medicaid budget was in excess of $52 billion – or just over a quarter of the total state two-year budget.

In 2011, the enacting of Senate Bill (S.B.) 7[1] required a "quality-based outcomes" payment program for Texas Medicaid based on "the extent to which the (provider) reduces potentially preventable events" using quality measures that "have the greatest effect on improving quality of care and the efficient use of services." This is advancement beyond the payment reforms enacted by other states such as Maryland and New York. The Texas legislation was recognized by the National Association of Medicaid Directors for incentivizing innovations and improvements in hospital-based care, patient management, and follow-up.[2]

Two other important aspects of S.B. 7 were the creation of the Texas Institute of Health Care Quality and Efficiency and authorization of the Medicaid/CHIP Quality-Based Payment Advisory Committee. The general mandate of the Institute is to advise the legislature on ways to improve the quality and efficiency of health care delivery, improve reporting and transparency regarding health care information, and implementation of collaborative payment and health care delivery systems. The Quality-Based Payment Advisory Committee focuses on reimbursement systems, and standards and benchmarks for quality and efficiency. Reducing potentially preventable events, including PPCs, is a focus for both entities.

The reduction of PPCs for Medicaid and CHIP enrollees is also an important component of the Healthcare Transformation and Quality Improvement Program 1115 Waiver approved by The Centers for Medicare and Medicaid Services (CMS) in 2011. Under this waiver, Delivery

[1] State of Texas Senate Bill 7. *82nd Legislature, 1st Called Session, 2011*.

[2] National Association of Medicaid Directors. Policy Brief - State Medicaid directors driving innovation: Payment reform. medicaiddirectors.org. July, 2012. medicaiddirectors.org/node/472.

System Reform Incentive Payment Pool (DSRIP) funding provides incentives for hospitals and other providers to develop and implement programs to improve access, quality, and efficiency in their delivery of care in four categories. Two of these categories, quality improvements and population focused improvements, could include specific programs to reduce PPCs at the provider level.

Measuring and reporting preventable hospital complications

Hospital complications are an indicator for quality of care because they may reflect poor clinical care or poor coordination of services during hospitalization. These events carry a significant cost to patients. For example, approximately 1.7 million healthcare-associated infections lead to 100,000 deaths in the United States each year. The monetary costs of these events are also significant, totaling over $10 billion annually. The increased costs resulting from hospital complications can be passed on to payers because the diagnosis codes linked to complications frequently increase Diagnosis Related Group (DRG) payment.

Medicare payment initiatives are being linked to measures of complications including the Agency for Healthcare Research and Quality's (AHRQ) Patient Safety Indicators (PSIs) and the eight Hospital Acquired Condition Measures (HACs), defined by CMS. The PPC algorithm developed by 3M™ includes these broad categories, but expands on them by using 1,450 diagnoses identified with PPCs to group admissions into a total of 65 PPC categories based on similarities in clinical presentation and clinical impact.

The 3M™ PPC software first identifies conditions not present on admission (POA) and then determines whether those conditions were potentially preventable given the patient's reason for admission, procedures, and underlying medical conditions. Accurate coding of the POA indicators is particularly important as it serves two primary purposes: (1) to create a method for identifying PPCs from among diagnoses not present on admission, and (2) to allow only those diagnoses designated as POA to be used for assessing the risk of incurring complications.

Although the PPC algorithm has a broader overall scope than the HACs and PSIs, only a defined subset of diagnosis codes and procedure codes are eligible for consideration for PPCs. Also, a PPC diagnosis may be preventable for some types of patients, but not for others. Patients with certain catastrophic illnesses that are particularly susceptible to a range of complications (e.g., HIV) are excluded from consideration.

Because not all DRG categories require the same treatment resources, Healthcare Cost and Utilization Project (HCUP) Relative PPC weights are assigned to each PPC category. The total of PPC weights thus provides a better overall measure of the impact of PPCs in a healthcare system.

Methodology

The PPC methodology developed by 3M™ is distinct from other methods of measuring complications. Complete documentation on the logic is available in 3M documentation, which is found on the HHSC web-page for potentially preventable events at http://www.hhsc.state.tx.us/hhsc_projects/ECI/Potentially-Preventable-Events.shtml. This methodology has been used with the Florida, Maryland, and Utah all-payer populations, the New York Medicaid population, and the Medicare population.

The PPC algorithm is based on the All Patient Refined Diagnosis Related Groups (APR-DRGs) classification scheme. The APR-DRG system developed by 3M™ uses diagnoses and POA indicators, procedures, age, sex, and discharge status to assign DRG and severity of illness (SOI) subclasses to hospital stays. The 314 base APR-DRG categories each have 4 possible SOI subclasses. The PPC algorithm considers each of the possible admission categories in combination with any diagnoses acquired during the hospital stay, and in certain cases additional criteria including age, gender, or particular procedures are also considered.

Defining PPCs

The PPC classification system first assigns each inpatient admission to one of the 1,256 APR-DRGs. Next, the exclusions for patients with severe or catastrophic conditions are identified. Finally, the remaining encounters are considered PPC candidate admissions and evaluated for PPCs. Multiple PPCs can be assigned to an admission if they are not clinically overlapping.

The 65 PPC types are categorized into eight PPC groups identified by 3M. These groups are defined by clinical similarities.[3] They are:

- Extreme Complications
- Cardiovascular-Respiratory Complications
- Gastrointestinal Complications
- Perioperative Complications
- Infectious Complications
- Malfunctions, Reactions, etc.
- Obstetrical Complications
- Other Medical and Surgical Complications

To account for differences in resource utilization, HCUP Relative PPC weights were assigned by 3M™ to each PPC category. These weights were determined based on resource utilization from national medical data. High resource PPCs are weighted more heavily than PPCs requiring less resources. These weights are provided in Appendix A.

[3] *Identifying Potentially Preventable Complications Using a Present on Admission Indicator*. Hughes, M.D., et al., 2006, Health Care Financing Review, Vol. 27, pp. 63-82.

Data inclusion

Encounter data from Texas Medicaid, including fee-for-service (FFS), STAR, STAR+PLUS, STAR Health, and CHIP programs are included in this report. Only inpatient hospital encounters (identified by bill type) with paid status were considered for inclusion. From this overall dataset, certain data were then excluded based on 3M exclusionary criteria and/or due to data quality. These data that were excluded are described within this report.

According to the Texas Health and Human Services System Consolidated Budget (http://www.hhsc.state.tx.us/about_hhsc/finance/2016-2017.pdf page 111), inpatient hospital costs for 2014-2015 are estimated to be about $8.31 billion (all funds). These amounts include inpatient services for general hospitals (including TEFRA based hospitals) and psychiatric hospitals. These amounts do not include crossover claims paid for inpatient services by Texas Medicaid for Medicaid recipients who are also enrolled in Medicare (dual eligibles).

For this analysis, hospitals were uniquely identified using their National Provider Identifier (NPI). The FFS encounters include the Texas Provider Identifier (TPI) which was crosswalked to the appropriate NPI.

Exclusions

Admissions are excluded from consideration through the PPC algorithm in the following categories:

> ***Medicaid / Medicare Dual Eligibility*** — Patients who were dually eligible for both Medicaid and Medicare during the measurement year were excluded. The Medicaid administrative data will not include a patient's complete history because coverage is also provided by Medicare.
>
> ***Hospitals with Less than 30 Admissions*** – Admissions from hospitals with less than 30 total admissions were excluded because the POA quality check results are not deemed reliable when the claims volume is low.
>
> **3M™ *defined PPC Exclusions*** — Only the 3M™ defined subset of diagnosis codes and procedure codes are eligible for consideration for PPCs. The 65 categories of PPCs are defined based on diagnoses and POA, procedures and procedure dates, and enrollee age. A PPC diagnosis may be preventable only in certain patient cases, e.g. obstetric complications occur in only females who deliver after an admission. Admissions for patients with severe or catastrophic illnesses, including those with trauma, HIV, and major or metastatic malignancies are also excluded. The 3M manual offers a detailed list of software exclusions.

POA Quality Validation

POA indicators are crucial for the identification of PPCs, however, the quality and consistency of this indicator varies greatly among hospitals. Assessing the quality of these data can be done using some underlying characteristics of the indicator, and expectations based on usual findings.

For example, certain conditions should almost never be coded as acquired during a hospital stay, so a hospital having more than 7.5% of these secondary diagnoses coded as hospital acquired

(POA=N) would be highly questionable. Alternately, a usual reasonable number of hospital acquired conditions is expected based on admission data from many hospitals (excluding certain types of diagnoses known to have substantially different POA rates). Hospitals with more than 96% of secondary diagnoses (not counting excluded diagnoses) coded as POA=Y is not considered reliable.

The POA quality screening criteria was developed by 3M™ based on statistical criteria and clinical consensus. Two levels of POA quality were defined for each criterion, the "red zone" and the "grey zone". Hospitals failing in the "red zone" for ONE or more criterion or in the "grey zone" for TWO or more criteria are identified as having questionable data and are considered to have failed POA quality check. Admissions for these hospitals are not included in statewide analyses.

POA indicator value "U" (no information in the record) is mapped to "N" (not present on admission), and value "W" (clinically undetermined) is mapped to "Y" (present on admission).Admissions from hospitals with questionable data are not considered in calculating state averages (also called norms).

The POA quality screening criteria applied are:

Quality Screen 1: High percentage Non-POA for secondary diagnoses on the Pre-Existing List
This criterion identifies hospitals with a high percent non-POA (POA = N) for pre-existing secondary diagnosis codes.

- Red Zone: % Non POA on Pre-Exist $\geq$ 7.5%
- Grey Zone: 5% $\leq$ % Non POA on Pre-Exist < 7.5%

Quality Screen 2: High percentage POA for secondary diagnoses
This criterion identifies hospitals with an extremely high percent present on admission (POA = Y) for secondary diagnosis codes (excluding exempt, pre-existing, and OB 7600x-7799x codes).

- Red Zone: % POA $\geq$ 96%
- Grey Zone: 93% $\leq$ % POA < 96%

Quality Screen 3: Low percentage POA for secondary diagnoses
This criterion identifies hospitals with an extremely low percent present on admission for secondary diagnoses codes (excluding exempt, pre-existing, and OB 7600x-7799x codes).

- Red Zone: % POA $\leq$ 70%
- Grey Zone: 70% < % POA $\leq$ 77%

Quality Screen 4: High percentage POA for secondary diagnoses on the Elective Surgical List
This criterion identifies hospitals with a high percent non-POA (POA = N) for elective surgery secondary diagnosis codes.

- Red Zone: % POA $\geq$ 40%

- Grey Zone: $30\% \leq \%\ POA < 40\%$

PPC Calculations

The 3M™ PPC software identifies PPCs, but it does not calculate reporting rates. The calculation of provider summaries, including adjustment for case mix is done in a separate set of steps following logic recommended by 3M™.

After PPC are assigned to admissions (for one or more of the 65 PPC categories), a state norm PPC rate for each admission APR-DRG with SOI level is calculated for each PPC category. Using PPC data from all hospitals passing the POA quality checks, the PPC rate (total number of PPCs in each category divided by the total number of admissions at risk for that PPC category) is calculated within each admission APR-DRG SOI. Each admission may be included in the pool of admissions at risk for some PPC categories, but not for others.

For each provider, the expected number of PPC in each category is calculated by summing the expected PPC for the category across all APR-DRG SOI. Each of these is determined by multiplying the number of admissions at risk for the PPC category (within the APR-DRG SOI) by the state norm.

To account for differences in resource utilization, the actual and expected PPC are multiplied by the PPC weight (from HCUP values) for the category.

The actual and expected PPC weights are both summed across PPC categories to get the total actual and expected PPC for the provider. The actual to expected ratio is the total actual PPC weights divided by the total expected PPC weights.

An example of PPC calculations for individual providers are found in Appendix B.

To separate the cost of complications from costs which would normally have been associated with the initial cause of admission, a marginal PPC expenditure is estimated using the entire pool of eligible admissions and a simple regression model. The general form given by:

$$\text{Expenditure} = \alpha + \beta_j\ PPC_{i,j} + \Omega_k\ \text{APR DRG}_{k,i} + \varepsilon_i$$

where expenditure refers to the expenditure of the i^{th} encounter and the PPC marginal expenditure is calculated above that of an assigned admission APR DRG. In basic terms, the expenditures for admissions with and without PPCs are compared accounting for the admission APR-DRG, and estimates of the additional expenditures associated with each PPC category are calculated. The marginal cost for PPC in each category can be summed for a provider to estimate the total expenditures attributable to PPCs. Estimates must be significantly different from zero to be used in determining estimated costs.

Results

Provider Data Exclusions for POA quality

Because of the importance of POA data in accurately identifying PPCs, providers that do not meet the POA validity checks are excluded from summary reporting. Table 1 shows the admissions excluded based on the POA validity checks. For a complete description of the POA red zone and grey zone validity checks, see the POA Quality Validation section in the Methodology.

Table 1. Data exclusion for POA data quality

	Red zone failures					
Program	***Quality Screen 1:*** High % Non-POA for secondary diagnoses on the Pre-Existing List	***Quality Screen 2:*** High % POA for secondary diagnoses	***Quality Screen 3:*** Low % POA for secondary diagnoses	***Quality Screen 4:*** High % POA for secondary diagnoses on the Elective Surgical List	***2+ grey zone failures***	***Total admissions excluded for POA data quality***
STAR	128,676	4,157	32,478	0	34,606	171,516
STAR+PLUS	14,374	5,055	5,530	0	4,055	25,040
STAR Health	900	1,024	251	0	340	2,278
FFS	79,532	3,041	43,448	0	21,818	113,665
All Medicaid	**223,482**	**13,277**	**81,707**	**0**	**60,819**	**312,499**
CHIP	2,139	636	394	0	1,562	4,405
Medicaid + CHIP	**225,621**	**13,913**	**82,101**	**0**	**62,381**	**316,904**

The most common issue was for secondary conditions that are unlikely to be acquired during a hospital stay to be coded as POA=N, or not pre-existing. The second most common failure, by total admissions was for providers having <76% of secondary conditions coded as present on admission (POA=Y). The exceptions to this were for STAR Health and CHIP where it was more common to have admissions rejected for providers with >96% of secondary conditions coded as present on admission.

Overall, more than half of all admissions that could be considered for PPCs are excluded because of poor provider POA data quality.

Admissions considered at risk for PPC

A total of 241,686 candidate admissions were identified from Medicaid and CHIP encounters for fiscal year 2013. Table 2 provides a summary of these admissions at risk for PPC.

Table 2. Summary of admissions at risk for PPCs during SFY 2013

Patient care category[1]		Program						
		STAR	STAR+PLUS	STAR Health	FFS	All Medicaid	CHIP	Medicaid + CHIP
Pediatric	Respiratory	7,943	58	159	2,945	11,105	481	11,586
	Other Medical	11,262	167	292	5,407	17,128	1,097	18,225
	Other Surgical	3,210	49	89	1,767	5,115	583	5,698
	MH/SA[2]	4,232	470	1,368	3,582	9,652	1,211	10,863
	Subtotal	26,647	744	1,908	13,701	43,000	3,372	46,372
Adult	Circulatory	1,230	3,962	0	3,258	8,450	12	8,462
	Other Medical	6,595	16,090	48	13,676	36,409	177	36,586
	Other Surgical	3,351	4,623	14	5,218	13,206	85	13,291
	MH/SA[2]	2,805	5,477	155	2,382	10,819	143	10,962
	Subtotal	13,981	30,152	217	24,534	68,884	417	69,301
Obstetrics		80,901	1,144	132	33,429	115,606	69	115,675
Newborn		6,814	4	10	3,193	10,021	2	10,023
Ungrouped		295	2	0	17	314	1	315
Total		**128,638**	**32,046**	**2,267**	**74,874**	**237,825**	**3,861**	**241,686**

[1]Based on major diagnostic categories (MDC), procedure codes, and age.
[2]Mental health or substance abuse.

Overall, 47% of candidate admissions were for obstetrics, although in programs other than STAR obstetrics admissions were less than 20% of the total. Among non-obstetric admissions, the proportion of adult to pediatric admissions is nearly equal for STAR and FFS, but is skewed by program enrollment criteria for other programs (e.g., STAR Health and CHIP serve children).

PPC categorization

A total of 11,060 admissions were identified as PPCs. The general clinical categories for these admissions are summarized in Table 3.

Table 3. PPC admissions by clinical group.

PPC Group	Number of PPC Events	% of Total PPC Events	PPC Weights	% of Total PPC Weights	PPC Expenditures[1]	% of Total PPC Expenditures
1 Extreme Complications	849	7.68%	1570.14	21.47%	$10,036,530.87	22.42%
2 Cardiovascular-Respiratory Complications	1,660	15.01%	1644.68	22.49%	$9,383,414.82	20.96%
3 Gastrointestinal Complications	275	2.49%	309.51	4.23%	$1,484,072.02	3.32%
4 Perioperative Complications	501	4.53%	402.71	5.51%	$4,324,272.19	9.66%
5 Infectious Complications	1,400	12.66%	1504.96	20.57%	$5,859,020.92	13.09%
6 Malfunctions, Reactions, etc.	361	3.26%	452.16	6.18%	$6,736,869.44	15.05%
7 Obstetrical Complications	4,650	42.04%	397.33	5.43%	$2,598,276.82	5.80%
8 Other Medical and Surgical Complications	1,364	12.33%	1033.04	14.12%	$4,338,753.03	9.69%

[1]Expenditures data includes the detail paid amount from FFS claims, which is an estimated cost. Expenditures are estimated costs of PPC, based on 3M developed marginal cost increase formula. Data used in this calculation includes the detail paid amount from FFS claims, which is an estimated cost.

Statewide results

Overall, 3.6% of admissions at risk for any PPC had at least one PPC, however the PPC rate for pediatric admissions is very low (<1%). This is partly due to the way the PPC algorithm is developed for this population. Patients under 18 years old are considered at risk for only a small subset of PPC categories. Table 4 shows PPC, weights and expenditures summarized for all Texas Medicaid and CHIP programs by patient care categories.

For Adult, non-obstetric admissions, 5.7% of candidate admissions had at least one PPC. The rate is highest for adult surgical admissions (10.2%) and less for obstetrical admissions (4.1%). Adult surgical admissions also have the highest PPC weights per candidate admission. Not only are they most likely to have PPCs, but the relative weight of these PPCs averages 1.12 (weights > 1 are more resource intensive). In contrast, PPC for obstetric admissions have an average relative weight of just 0.16 (far lower resource intensive than usual).

Table 4. Statewide PPC for Texas Medicaid and CHIP, SFY 2013

Patient care category[1]		Total Candidate Admissions[2]	Admissions with ≥1 PPC	Total PPC	Total PPC Weights	PPC Weights per PPC Admission[3]	Total PPC Expenditures[5]
Pediatric	Respiratory	11,586	7	8	10.95	1.56	$170,036.21
	Other Medical	18,225	8	8	14.14	1.77	$396,391.65
	Other Surgical	5,698	48	52	64.63	1.35	$842,275.40
	MH/SA[2]	10,863	0	0	0.00	0.00	$0.00
	Subtotal	46,372	63	68	89.72	1.42	$1,408,703.26
Adult	Circulatory	8,462	788	1,288	1300.23	1.65	$7,312,011.43
	Other Medical	36,586	1,717	2,347	2567.94	1.50	$14,875,520.22
	Other Surgical	13,291	1,357	2,166	2433.68	1.79	$15,860,626.55
	MH/SA[4]	10,962	93	103	96.05	1.03	$415,350.42
	Subtotal	69,301	3,955	5,904	6397.89	1.62	$38,463,508.61
Obstetrics		115,675	4,685	5,087	825.65	0.18	$4,867,872.02
Newborn		10,023	1	1	1.27	1.27	$21,126.19
Ungrouped		315	0	0	0.00	0.00	$0.00
Total		**241,686**	**8,704**	**11,060**	**7,314.54**	**1.27**	**$44,761,210.09**

[1]Based on major diagnostic categories (MDC), procedure codes, and age.

[2]Admissions at risk for at least 1 PPC.

[3]Total PPC per admission having at least 1 PPC.

[4]Mental health or substance abuse.

[5]Expenditures data includes the detail paid amount from FFS claims, which is an estimated cost. Expenditures are estimated costs of PPC, based on 3M developed marginal cost increase formula. Data used in this calculation includes the detail paid amount from FFS claims, which is an estimated cost.

PPC categories

Tables 5 and 6 summarize PPCs grouped by PPC category. Table 5 includes the top 25 PPC categories by total PPC count. Table 6 includes the top 25 PPC categories by total PPC weights.

Four of the top ten categories for number of PPCs are obstetrical. Together they account for more than 30% of all PPCs, but only about 5% of PPC expenditures. Septicemia & severe infections, and shock also have relatively high numbers of PPC, and these categories together account for more than 18% of PPC costs.

Table 5. Top 25 PPC categories by PPC count.

PPC Category		PPC Count	% of Total PPCs	PPC Weights	% of Total PPC Weights	PPC Expenditures[1]	% of Total PPC Expenditures
55	Obstetrical Hemorrhage w/out Transfusion	1,469	13.28%	80.04	1.09%	$1,154,770.72	2.58%
57	Obstetric Lacerations & Other Trauma w/out Instrumentation	1,182	10.69%	40.46	0.55%	$0.00	0.00%
24	Renal Failure w/out Dialysis	923	8.35%	554.18	7.58%	$1,788,199.60	3.99%
65	Urinary Tract Infection	708	6.40%	565.39	7.73%	$2,262,049.77	5.05%
59	Medical & Anesthesia Obstetric Complications	559	5.05%	60.50	0.83%	$0.00	0.00%
56	Obstetrical Hemorrhage w/ Transfusion	506	4.58%	149.21	2.04%	$1,103,848.63	2.47%
3	Acute Pulmonary Edema and Respiratory Failure w/out Ventilation	494	4.47%	383.20	5.24%	$1,826,087.95	4.08%
58	Obstetric Lacerations & Other Trauma with Instrumentation	436	3.94%	23.81	0.33%	$0.00	0.00%
35	Septicemia & Severe Infections	416	3.76%	568.80	7.78%	$3,060,254.92	6.84%
9	Shock	325	2.94%	490.43	6.70%	$5,219,163.73	11.66%
5	Pneumonia & Other Lung Infections	297	2.69%	398.62	5.45%	$1,755,756.98	3.92%
62	Delivery with Placental Complications	244	2.21%	8.91	0.12%	$0.00	0.00%
14	Ventricular Fibrillation/Cardiac Arrest	236	2.13%	281.22	3.84%	$0.00	0.00%
40	Post-Operative Hemorrhage & Hematoma w/out Hemorrhage Control Proc. or I&D Proc.	222	2.01%	130.53	1.78%	$634,926.68	1.42%
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	196	1.77%	536.31	7.33%	$2,851,342.55	6.37%
61	Other Complications of Obstetrical Surgical & Perineal Wounds	159	1.44%	18.28	0.25%	$0.00	0.00%
6	Aspiration Pneumonia	139	1.26%	173.48	2.37%	$1,370,583.17	3.06%

PPC Category		PPC Count	% of Total PPCs	PPC Weights	% of Total PPC Weights	PPC Expenditures[1]	% of Total PPC Expenditures
1	Stroke & Intracranial Hemorrhage	127	1.15%	145.05	1.98%	$963,485.40	2.15%
52	Inflammation & Other Complications of Devices, Implants or Grafts except Vascular Infection	126	1.14%	119.16	1.63%	$540,018.50	1.21%
47	Encephalopathy	120	1.08%	115.67	1.58%	$0.00	0.00%
11	Acute Myocardial Infarction	119	1.08%	84.00	1.15%	$631,856.32	1.41%
42	Accidental Puncture/Laceration during Invasive Proc.	117	1.06%	51.72	0.71%	$726,003.90	1.62%
16	Venous Thrombosis	113	1.02%	163.56	2.24%	$1,855,698.58	4.15%
19	Major Liver Complications	111	1.00%	113.26	1.55%	$852,544.12	1.90%
8	Other Pulmonary Complications	106	0.96%	94.85	1.30%	$531,399.41	1.19%

[1]Marginal expenditure estimates not significantly different from zero based on the regression model fit, are not considered reliable for inclusion in total PPC expenditure calculations. For these categories, $0.00 are shown for the expenditures. Expenditures data includes the detail paid amount from FFS claims, which is an estimated cost. Expenditures are estimated costs of PPC, based on 3M developed marginal cost increase formula. Data used in this calculation includes the detail paid amount from FFS claims, which is an estimated cost.

The top categories of PPC by PPC weights is influenced by both how common these PPC events are and how resource intensive. This list is topped by fairly serious medical conditions require substantial resources to treat that are also among the more common PPC categories. The top 5 categories in Table 5 account for 23% of the total PPCs and have an average PPC weight of 1.05. The PPC categories further down this list tend to have higher average PPC Weights, indicating that resource intensity is a bigger contributor to total weights than number of events.

Table 6. Top 25 PPC categories by PPC weights.

PPC Category		PPC Count	% of Total PPCs	PPC Weights	% of Total PPC Weights	PPC Expenditures[1]	% of Total PPC Expenditures
35	Septicemia & Severe Infections	416	3.76%	568.80	7.78%	$3,060,254.92	6.84%
65	Urinary Tract Infection	708	6.40%	565.39	7.73%	$2,262,049.77	5.05%
24	Renal Failure w/out Dialysis	923	8.35%	554.18	7.58%	$1,788,199.60	3.99%
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	196	1.77%	536.31	7.33%	$2,851,342.55	6.37%
9	Shock	325	2.94%	490.43	6.70%	$5,219,163.73	11.66%

PPC Category		PPC Count	% of Total PPCs	PPC Weights	% of Total PPC Weights	PPC Expenditures[1]	% of Total PPC Expenditures
5	Pneumonia & Other Lung Infections	297	2.69%	398.62	5.45%	$1,755,756.98	3.92%
3	Acute Pulmonary Edema and Respiratory Failure w/out Ventilation	494	4.47%	383.20	5.24%	$1,826,087.95	4.08%
14	Ventricular Fibrillation/Cardiac Arrest	236	2.13%	281.22	3.84%	$0.00	0.00%
21	Clostridium Difficile Colitis	106	0.96%	181.00	2.47%	$0.00	0.00%
6	Aspiration Pneumonia	139	1.26%	173.48	2.37%	$1,370,583.17	3.06%
16	Venous Thrombosis	113	1.02%	163.56	2.24%	$1,855,698.58	4.15%
56	Obstetrical Hemorrhage w/ Transfusion	506	4.58%	149.21	2.04%	$1,103,848.63	2.47%
1	Stroke & Intracranial Hemorrhage	127	1.15%	145.05	1.98%	$963,485.40	2.15%
54	Infections due to Central Venous Catheters	57	0.52%	142.25	1.94%	$3,908,468.67	8.73%
40	Post-Operative Hemorrhage & Hematoma w/out Hemorrhage Control Proc. or I&D Proc.	222	2.01%	130.53	1.78%	$634,926.68	1.42%
52	Inflammation & Other Complications of Devices, Implants or Grafts except Vascular Infection	126	1.14%	119.16	1.63%	$540,018.50	1.21%
63	Post-Operative Respiratory Failure with Tracheostomy	13	0.12%	116.43	1.59%	$1,268,943.48	2.83%
47	Encephalopathy	120	1.08%	115.67	1.58%	$0.00	0.00%
19	Major Liver Complications	111	1.00%	113.26	1.55%	$852,544.12	1.90%
37	Post-Operative Infection & Deep Wound Disruption w/out Proc.	84	0.76%	106.52	1.46%	$1,774,600.20	3.96%
34	Moderate Infections	63	0.57%	99.85	1.37%	$0.00	0.00%
2	Extreme CNS Complications	64	0.58%	99.42	1.36%	$337,439.28	0.75%
48	Other Complications of Medical Care	63	0.57%	99.34	1.36%	$744,885.73	1.66%
8	Other Pulmonary Complications	106	0.96%	94.85	1.30%	$531,399.41	1.19%
17	Major Gastrointestinal Complications w/out Transfusion or Significant Bleeding	99	0.90%	94.01	1.29%	$296,374.61	0.66%

[1]Marginal expenditure estimates not significantly different from zero based on the regression model fit, are not considered reliable for inclusion in total PPC expenditure calculations. For these categories, $0.00 are shown for the expenditures. Expenditures data includes the detail paid amount from FFS claims, which is an estimated cost. Expenditures are estimated costs of PPC, based on 3M developed marginal cost increase formula. Data used in this calculation includes the detail paid amount from FFS claims, which is an estimated cost.

APR-DRG of admission

Tables 7 and 8 summarize PPCs grouped by the APR-DRG of the admission. Table 7 includes the top 25 APR-DRG by total PPC count. Table 8 includes the top 25 APR-DRG by total PPC weight.

As shown in Table 4, obstetric admissions account for more than half of all PPCs, however it is important to note the high percentage of candidate admissions that are obstetric. Major bowel procedures bring significant risks for complications in multiple areas of care, so it is not surprising that they should result in a relatively high number of PPCs, despite the modest number of candidate admissions in this category.

Table 7. The top 25 APR-DRG categories for admissions by PPC count.

APR-DRG of candidate admissions		Candidate Admissions[1]	Admissions with ≥1 PPC	Total PPC	Total PPC Weights	PPC Weights per PPC Admission[2]
560	Vaginal delivery	67,307	3,121	3,262	301.94	1.0
540	Cesarean delivery	36,619	1,258	1,471	404.05	1.2
541	Vaginal delivery w sterilization &/or D&C	2,033	219	253	40.88	1.2
221	Major small & large bowel proc.	741	134	246	306.33	1.8
194	Heart failure	2,280	151	178	169.13	1.2
720	Septicemia & disseminated infections	2,254	141	178	187.93	1.3
165	Coronary bypass w cardiac cath. or percutaneous cardiac proc.	216	87	168	157.98	1.9
460	Renal failure	1,712	106	155	186.02	1.5
021	Craniotomy except for trauma	526	79	141	163.45	1.8
130	Respiratory system diagnosis w ventilator support 96+ hours	406	81	141	166.23	1.7
139	Other pneumonia	4,553	100	140	155.06	1.4
710	Infectious & parasitic diseases including HIV w OR proc.	608	85	128	148.38	1.5
133	Pulmonary edema & respiratory failure	1,217	81	114	119.52	1.4
045	CVA & precerebral occlusion w infarct	977	73	111	128.12	1.5
140	Chronic obstructive pulmonary disease	2,051	89	108	108.81	1.2
951	Moderately extensive proc. unrelated to principal diagnosis	703	60	105	119.68	1.8
173	Other vascular proc.	465	61	95	99.39	1.6

APR-DRG of candidate admissions		Candidate Admissions[1]	Admissions with ≥1 PPC	Total PPC	Total PPC Weights	PPC Weights per PPC Admission[2]
305	Amputation of lower limb except toes	257	60	95	105.61	1.6
163	Cardiac valve proc. w/o cardiac cath.	128	37	92	100.40	2.5
166	Coronary bypass w/o cardiac cath. or percutaneous cardiac proc.	123	46	90	85.08	2.0
950	Extensive proc. unrelated to principal diagnosis	203	37	83	108.10	2.2
190	Acute myocardial infarction	463	51	80	86.78	1.6
174	Percutaneous cardiovascular proc. with AMI	460	52	77	72.75	1.5
383	Cellulitis & other bacterial skin infection	3,553	57	73	71.38	1.3
137	Major resp. infection & inflammations	765	50	72	95.39	1.4

[1]Admissions at risk for at least 1 PPC.

[2]Total PPC per admission having at least 1 PPC.

In table 8, Obstetrical admissions are again at the top of the list due to the large number of admissions in this category despite having the lowest PPC weight per admission, as shown in Table 4. Major procedures and admissions for conditions involving major system failures, including septicemia may result in complications with greater treatment resource requirements, while less serious conditions, such as chronic obstructive pulmonary disease appear on this list due to a combination of seriousness and greater frequency.

Table 8. The top 25 APR-DRG categories for admissions by PPC weight.

APR-DRG of candidate admissions		Candidate Admissions[1]	Admissions with ≥1 PPC	Total PPC	Total PPC Weights	PPC Weights per PPC Admission[2]
540	Cesarean delivery	36,619	1,258	1,471	404.05	1.2
221	Major small & large bowel procedures	741	134	246	306.33	1.8
560	Vaginal delivery	67,307	3,121	3,262	301.94	1.0
720	Septicemia & disseminated infections	2,254	141	178	187.93	1.3
460	Renal failure	1,712	106	155	186.02	1.5
194	Heart failure	2,280	151	178	169.13	1.2

APR-DRG	of candidate admissions	Candidate Admissions[1]	Admissions with ≥1 PPC	Total PPC	Total PPC Weights	PPC Weights per PPC Admission[2]
130	Respiratory system diagnosis w ventilator support 96+ hours	406	81	141	166.23	1.7
021	Craniotomy except for trauma	526	79	141	163.45	1.8
165	Coronary bypass w cardiac cath. or percutaneous cardiac proc.	216	87	168	157.98	1.9
139	Other pneumonia	4,553	100	140	155.06	1.4
710	Infectious & parasitic diseases including HIV w/ OR proc.	608	85	128	148.38	1.5
045	CVA & precerebral occlusion w infarct	977	73	111	128.12	1.5
951	Moderately extensive procedure unrelated to principal diagnosis	703	60	105	119.68	1.8
133	Pulmonary edema & respiratory failure	1,217	81	114	119.52	1.4
140	Chronic obstructive pulmonary disease	2,051	89	108	108.81	1.2
950	Extensive procedure unrelated to principal diagnosis	203	37	83	108.10	2.2
305	Amputation of lower limb except toes	257	60	95	105.61	1.6
163	Cardiac valve procedures w/o cardiac catheterization	128	37	92	100.40	2.5
173	Other vascular procedures	465	61	95	99.39	1.6
137	Major respiratory infections & inflammations	765	50	72	95.39	1.4
190	Acute myocardial infarction	463	51	80	86.78	1.6
166	Coronary bypass w/o cardiac cath. or percutaneous cardiac proc.	123	46	90	85.08	2.0
220	Major stomach, esophageal & duodenal procedures	183	34	63	80.44	1.9
174	Percutaneous cardiovascular procedures w/ AMI	460	52	77	72.75	1.5
280	Alcoholic liver disease	562	40	59	71.80	1.5

[1]Admissions at risk for at least 1 PPC.

[2]Total PPC per admission having at least 1 PPC.

Provider results

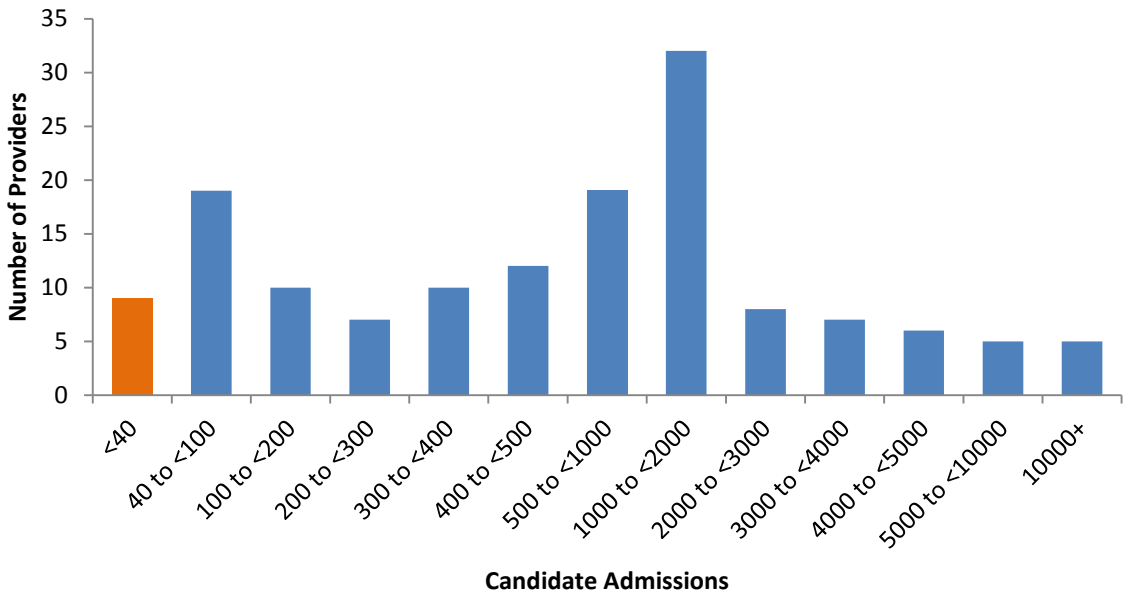
To provide for comparative assessment of providers, actual PPC weights for each provider were risk adjusted based on their case mix (i.e., APR-DRG/SOI) of candidate admissions. The expected PPC weight for the provider is determined, and the A/E ratio for the provider provides a measure of whether they are performing better (A/E ratio less than 1) or worse than would be expected based on their case mix.

Low volume providers can affect the reliability and interpretability of provider based summary statistics such as statewide percentile rankings. Individual results for these providers should also be interpreted with care. Consider an example provider with only 40 candidate admissions and 4 PPCs. Their PPC rate would be 10% (assuming neutral risk adjustment), but a difference of only one PPC could move their PPC rate to 7.5% or 12.5%; substantially different given the overall distribution of rates. Providers meeting either of the following criteria were considered low volume and were excluded from percentile calculations:

- Less than 40 candidate admissions
- Less than 5 admissions with a PPC

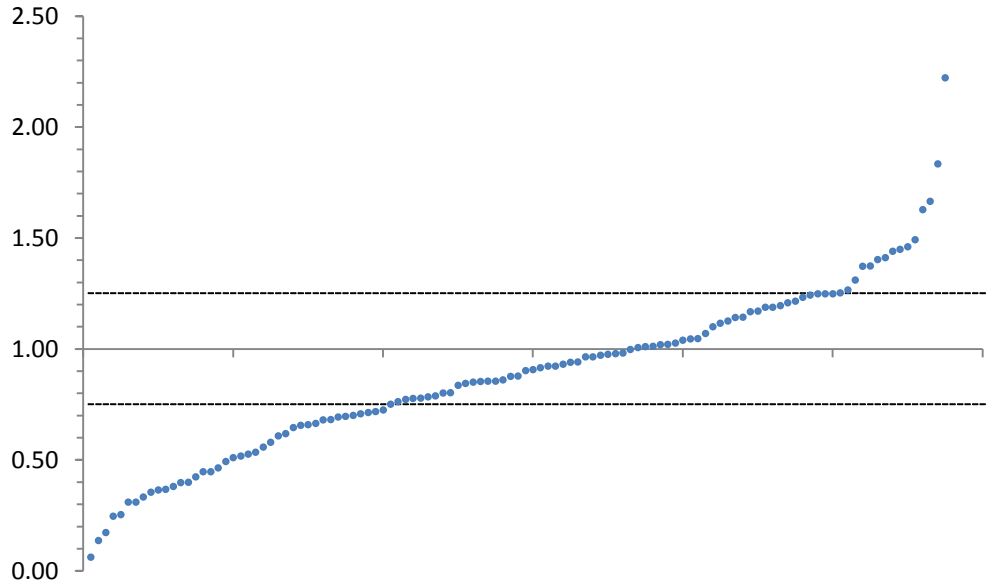
A total of 154 providers had admissions at risk for PPCs. Figure 1 shows the distribution of candidate admissions. Nine providers had fewer than 40 candidate admissions and an additional 29 had fewer than 5 admissions with a PPC. These were excluded from statewide percentile calculations.

Figure 1. Distribution of candidate admissions.



Considering the 116 providers passing the low volume thresholds, actual PPC rates (admissions with a PPC / admissions at risk for PPC) ranged from 0.3% to 10.5% (mean = 4.3%, median = 3.9%). The actual PPC count for these providers ranged from 5 to 1,161 PPC (mean = 95, median = 46). The actual PPC weights ranged from 0.38 to 797.56 (mean = 62.76 median = 22.33), while the expected weights ranged from 0.73 to 568.50 (mean = 62.54, median = 29.60). The distribution of A/E ratios for these providers is shown in Figure 2. Providers with A/E ratios <1 had fewer than expected PPCs while providers with A/E ratios >1 had more PPCs than expected based on their case mix.

Figure 2. A/E ratios for providers passing low volume thresholds.



Excluding the low volume providers, 26 providers (22%) had PPC weights "about as expected" with A/E ratios between 0.90 and 1.10. Only 15 providers (13%) had PPC weights much higher than expected (A/E ratio >1.25) and 40 (34%) had PPC weights much lower than expected (A/E ratio <0.75). These thresholds are included in figure 2. Clearly, performance varies across providers, and significant room for improvement exists for some individual providers.

The statewide PPC percentiles provide a benchmark for comparing individual providers. Providers with fewer PPC weights are considered to have better performance and thus higher percentile ranking. Thresholds for these rankings are presented in Table 9 with percentile distributions for admissions and PPCs. The absolute numbers are largely determined by provider volume, but provide additional context for interpreting individual provider results.

Table 9. PPC weight percentile rankings and distributions of admissions and PPCs

	25th percentile	50th percentile	90th percentile
PPC Weights	69.85	22.32	2.85
	Distributions		
	25th percentile	**50th percentile**	**90th percentile**
Total Number of Admissions	710	1,553	6,861
Number of Candidate Admissions	464	1,113	4,435
Number of PPC Admissions	20	39	154
Actual PPC counts	23	46	200

Interpretation

Overall PPC

Using data from only 154 providers that met the minimum data volume and quality requirements, over 11,000 PPC were identified with marginal costs estimated at over $44 million dollars for fiscal year 2013. While obstetrical admissions account for almost half of the total PPCs, they account for only about 10% of the estimated PPC expenditures. In contrast, adult surgical admissions are only 5% of the total candidate admissions, but account for 20% of the PPCs and 35% of the estimated PPC expenditures. Both of these areas provide opportunities for interventions that should improve quality for patients and reduce costs.

The PPC reports identify these areas more clearly than other measures of patient complications because they include broader areas of care with specific identification of the complications that are most likely to be preventable given the circumstance of the admission. In contrast, less than 0.5% of candidate admissions for PPC were identified with a HAC.

It is worth noting that PPCs often have the effect of changing the APR-DRG or SOI. In previous analyses as many as 31% of PPC admissions would have had a different APR-DRG or SOI without the PPC diagnosis. The differences had the effect of increasing the total case mix (resource use determined by APR-DRG) by 1.5% for the entire admission pool.

Because the results and rates presented in this report are based on all Medicaid and CHIP data for fiscal year 2013, there is no question of statistical significance as long the inferences made are related to that population. However, when comparing providers it is useful to consider the current data population as a sample representing a point in time, which would differ had it been taken at a different time. It is for this reason that the exclusions for low volume providers are made when calculating statewide statistics based on individual provider results.

Provider PPC

The distribution of PPC A/E ratios among the providers passing the low volume threshold shows that opportunities for improving PPC rates exist. The purpose of the provider analysis is to inform providers about areas where quality can be improved, both through inpatient care and throughout the continuum of care. Providers should consider their PPCs within different admission categories based on the number of candidate admissions, the number of PPCs, the PPC weights, and the marginal expenditures. This will lead to the most efficient interventions with the best opportunities to improve quality and reduce excess costs.

Many organizations are working on developing strategies to reduce the incidence of PPCs. Two valuable resources are:

- The Agency for Healthcare Research and Quality (AHRQ) funds research on patient safety. Information is available at www.ahrq.com.
- The Institute for Healthcare Improvement has tools and white papers addressing patient safety issues. Information is available at www.ihi.org.

Appendix A

PPC groups

PPC Group	Group Description
1	Extreme Complications
2	Cardiovascular-Respiratory Complications
3	Gastrointestinal Complications
4	Perioperative Complications
5	Infectious Complications
6	Malfunctions, Reactions, etc.
7	Obstetrical Complications
8	Other Medical and Surgical Complications

PPC categories with Healthcare Cost and Utilization Project (HCUP) based weights provided by 3M™

Note that PPC 22 was retired and replaced by PPCs 65 and 66, thus the total PPC categories in use is 65.

PPC Category	PPC Description	PPC Group	HCUP PPC Weight
1	Stroke & Intracranial Hemorrhage	2	1.1422
2	Extreme CNS Complications	1	1.5535
3	Acute Pulmonary Edema and Respiratory Failure without Ventilation	2	0.7757
4	Acute Pulmonary Edema and Respiratory Failure with Ventilation	1	2.7363
5	Pneumonia & Other Lung Infections	2	1.3421
6	Aspiration Pneumonia	2	1.2481
7	Pulmonary Embolism	2	1.3569
8	Other Pulmonary Complications	2	0.8949
9	Shock	1	1.5090
10	Congestive Heart Failure	2	0.4539
11	Acute Myocardial Infarction	2	0.7059
12	Cardiac Arrhythmias & Conduction Disturbances	2	0.3129
13	Other Cardiac Complications	2	0.4738
14	Ventricular Fibrillation/Cardiac Arrest	1	1.1916
15	Peripheral Vascular Complications except Venous Thrombosis	2	1.2928
16	Venous Thrombosis	2	1.4475
17	Major Gastrointestinal Complications without Transfusion or Significant Bleeding	3	0.9496

PPC Category	PPC Description	PPC Group	HCUP PPC Weight
18	Major Gastrointestinal Complications with Transfusion or Significant Bleeding	3	1.7717
19	Major Liver Complications	3	1.0203
20	Other Gastrointestinal Complications without Transfusion or Significant Bleeding	3	1.4782
21	Clostridium Difficile Colitis	5	1.7076
22	*This category intentionally excluded. Category 22 was retired and Categories 65 and 66 added.*	x	x
23	GU Complications except UTI	8	0.6261
24	Renal Failure without Dialysis	8	0.6004
25	Renal Failure with Dialysis	1	3.0882
26	Diabetic Ketoacidosis & Coma	8	0.8560
27	Post-Hemorrhagic & Other Acute Anemia with Transfusion	8	0.7676
28	In-Hospital Trauma and Fractures	8	0.3366
29	Poisonings except from Anesthesia	6	0.1828
30	Poisonings due to Anesthesia	6	0.0836
31	Decubitus Ulcer	8	2.2983
32	Transfusion Incompatibility Reaction	6	1.2215
33	Cellulitis	5	0.8284
34	Moderate Infections	5	1.5849
35	Septicemia & Severe Infections	5	1.3673
36	Acute Mental Health Changes	8	0.3539
37	Post-Operative Infection & Deep Wound Disruption without Procedure	4	1.2681
38	Post-Operative Wound Infection & Deep Wound Disruption with Procedure	4	2.4920
39	Reopening Surgical Site	4	1.5288
40	Post-Operative Hemorrhage & Hematoma without Hemorrhage Control Procedure or I&D Procedure	4	0.5880
41	Post-Operative Hemorrhage & Hematoma with Hemorrhage Control Procedure or I&D Procedure	4	1.0679
42	Accidental Puncture/Laceration during Invasive Procedure	4	0.4420
43	Accidental Cut or Hemorrhage during Other Medical Care	8	0.2017
44	Other Surgical Complication - Moderate	8	1.2212
45	Post-procedure Foreign Bodies	4	0.4926

PPC Category	PPC Description	PPC Group	HCUP PPC Weight
46	Post-Operative Substance Reaction & Non-O.R. Procedure for Foreign Body	4	0.6464
47	Encephalopathy	8	0.9639
48	Other Complications of Medical Care	8	1.5769
49	Iatrogenic Pneumothorax	6	0.6083
50	Mechanical Complication of Device, Implant & Graft	6	1.3008
51	Gastrointestinal Ostomy Complications	6	1.7150
52	Inflammation & Other Complications of Devices, Implants or Grafts except Vascular Infection	6	0.9457
53	Infection, Inflammation and Clotting Complications of Peripheral Vascular Catheters and Infusions	6	0.9613
54	Infections due to Central Venous Catheters	6	2.4957
55	Obstetrical Hemorrhage without Transfusion	7	0.0545
56	Obstetrical Hemorrhage with Transfusion	7	0.2949
57	Obstetric Lacerations & Other Trauma Without Instrumentation	7	0.0342
58	Obstetric Lacerations & Other Trauma With Instrumentation	7	0.0546
59	Medical & Anesthesia Obstetric Complications	7	0.1082
60	Major Puerperal Infection and Other Major Obstetric Complications	7	0.1697
61	Other Complications of Obstetrical Surgical & Perineal Wounds	7	0.1150
62	Delivery with Placental Complications	7	0.0365
63	Post-Operative Respiratory Failure with Tracheostomy	1	8.9560
64	Other In-Hospital Adverse Events	8	0.4012
65	Urinary Tract Infection	5	0.7986
66	Catheter-Related Urinary Tract Infection	5	0.9442

Appendix B

Example calculations for PPC provider reports

The imaginary state, Midlands, is served for hospital services by 3 providers. The people of Midlands suffer from a limited variety of conditions requiring hospitalization, and all admissions were assigned to 3 categories of APR-DRG (and SOI level 1).

Appendix Table A. Admissions by APR-DRG for Midlands providers.

	No. of Admissions			
APR-DRG	**Provider A**	**Provider B**	**Provider C**	**Total**
139 – Other pneumonia	124	72	75	**271**
194 – Heart failure	60	80	27	**167**
460 – Renal failure	76	75	28	**179**
Total	**260**	**227**	**130**	

Midlands has interest in only a limited number of PPC categories: (03) Acute Pulmonary Edema and Respiratory Failure without Ventilation, (19) Major Liver Complications, and (05) Pneumonia & Other Lung Infections.

The statewide PPC rate for each PPC category is calculated within APR-DRG using all admissions at risk for that PPC category.

Appendix Table B. Statewide PPC rates by PPC category and APR-DRG.

APR-DRG	PPC 03		PPC 19		PPC 05	
	PPC/at-risk admissions	**Rate**	**PPC/at-risk admissions**	**Rate**	**PPC/at-risk admissions**	**Rate**
139 – Other pneumonia	2/106	0.0189	0/129	0	0/0	0
194 – Heart failure	0/59	0	0/133	0	0/107	0
460 – Renal failure	1/138	0.0072	0/148	0	1/118	0.0085
Total PPC	**3/303**		**0/410**		**1/225**	
Overall Total PPC	**4 PPCs**					

Remember that every admission is at risk for only certain PPC categories, but an admission can be at risk for and have PPC in more than one PPC category.

Provider A had only 1 PPC (An admission for other pneumonia (APR-DRG 139) had a PPC category 3).

Appendix Table C. Provider A PPC and at-risk admissions by PPC category and APR-DRG.

APR-DRG	Total Admissions (From Table A)	PPC/at-risk admissions		
		PPC 03	PPC 19	PPC 05
139 – Other pneumonia	124	1/36	0/40	0/0
194 – Heart failure	60	0/14	0/54	0/42
460 – Renal failure	76	0/58	0/60	0/48
Total PPC		**1/108**	**0/154**	**0/90**
Overall Total PPC		**1 PPC**		

Substituting PPC weights for PPCs is done by multiplying the PPCs in each cell by the HCUP based weight (Appendix A) for that PPC category. Provider A had only one PPC, in category 3, so the total PPC weights is 0.7757 (the HCUP weight for PPC category 3 times 1 PPC).

The expected PPCs weights for Provider A are calculated by multiplying the at-risk admissions (Table C) by the statewide rates (Table B) to get the expected PPC for each category. Then, multiply the sum of expected PPC in each PPC category by the HCUP weight. For example, the total expected PPCs in category 3 is:

$$1.0980 = (36 \times 0.0189) + (14 \times 0) + (58 \times 0.0072)$$

and multiplying by the HCUP weight (0.7757) gives the total expected PPC weights for PPC category 3 of 0.8517. The sum of expected PPC weights for all categories is the overall expected PPC weights.

Appendix Table D. Provider A Expected PPCs by PPC category and APR-DRG.

APR-DRG	Expected PPCs or PPC weights		
	PPC 03	PPC 19	PPC 05
Expected PPC			
139 – Other pneumonia	0.6804	0	0
194 – Heart failure	0	0	0
460 – Renal failure	0.4176	0	0.4080
Total expected PPC	**1.0980**	**0**	**0.4080**
Total expected PPC weights	**0.8517**	**0**	**0.5476**
Overall total expected PPC weights	**1.3993**		

The actual to expected ratio (A/E ratio) for Provider A is 0.5543, which is the overall actual PPC weights (0.7757) divided by the overall total expected PPC weights (1.3993). Since the A/E ratio is less than one, Provider A is performing better than expected.

Provider B has a slightly lower number of admissions than Provider A, and a total of 3 PPCs. The total PPC weights for Provider B is 2.8935 (Table E).

Appendix Table E. Provider B PPC and at-risk admissions by PPC category and APR-DRG, and total PPC weights.

APR-DRG	Total Admissions (From Table A)	PPC/at-risk admissions		
		PPC 03	PPC 19	PPC 05
139 – Other pneumonia	72	1/57	0/66	0/0
194 – Heart failure	80	0/45	0/61	0/60
460 – Renal failure	75	1/63	0/66	1/56
Total PPC		**2/165**	**0/193**	**1/116**
Overall total PPC		**3 PPCs**		
Total PPC weights		**1.5514**	**0**	**1.3421**
Overall total PPC weights		**2.8935**		

The expected PPC weights for Provider B, based on case mix is only 1.8263 (Table F), so the A/E ratio for Provider B is1.584, indicating that Provider B has more than expected PPCs.

Appendix Table F. Provider B Expected PPCs by PPC category and APR-DRG.

APR-DRG	Expected PPCs or PPC weights		
	PPC 03	PPC 19	PPC 05
139 – Other pneumonia	1.0773	0	0
194 – Heart failure	0	0	0
460 – Renal failure	0.4536	0	
Total expected PPC	**1.5309**	**0**	**0.4760**
Total expected PPC weights	**1.1875**	**0**	**0.6388**
Overall total expected PPC weights	**1.8263**		

Provider C had no PPC, meaning that total PPC weights is also zero.

Appendix Table G. Provider C PPC and at-risk admissions by PPC category and APR-DRG

APR-DRG	Total Admissions (From Table A)	PPC/at-risk admissions		
		PPC 03	PPC 19	PPC 05
139 – Other pneumonia	75	0/13	0/23	0/0
194 – Heart failure	27	0/0	0/18	0/5
460 – Renal failure	28	0/16	0/22	0/14
Total PPC		**0/29**	**0/63**	**0/19**
Overall total PPC (weights)		**0 PPC (0 PPC weights)**		

The expected PPC weights are also low (0.4397) because this hospital has fewer admissions at risk. However, the A/E ratio would simply be zero by definition (0 / 0.4397) Although this provider may be performing better than expected, in reality all of the providers in Midlands would be considered too low volume for inclusion in percentile ranking calculations in Texas (by having fewer than 5 admissions with PPC). This requirement also makes it unnecessary to consider any standard correction for cases of the zero A/E ratio. The admissions for all 3 providers are included in the calculations of the statewide rates or norms however, because they meet the minimum threshold of 40 admissions.